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(54) Utility metering arrangement

(57) A utility meter comprises utility consumption metering means, at least two registers 13, 14 and switching means 12. These are arranged such that metering signals are switched from one register 13 to another register 14 at a change over point relating to a new accounting period. One register 13 will record the total consumption during a first accounting period whilst another register 14 records the running total consumption during the following accounting period. The utility metered may be gas, water or electricity and the switch 12 may be activated by local 17 or remote 16 time and calendar indicating devices. A group of registers may be used for each accounting period to record peak and off-peak consumption values. The accumulated consumption values on the registers may be displayed simultaneously.

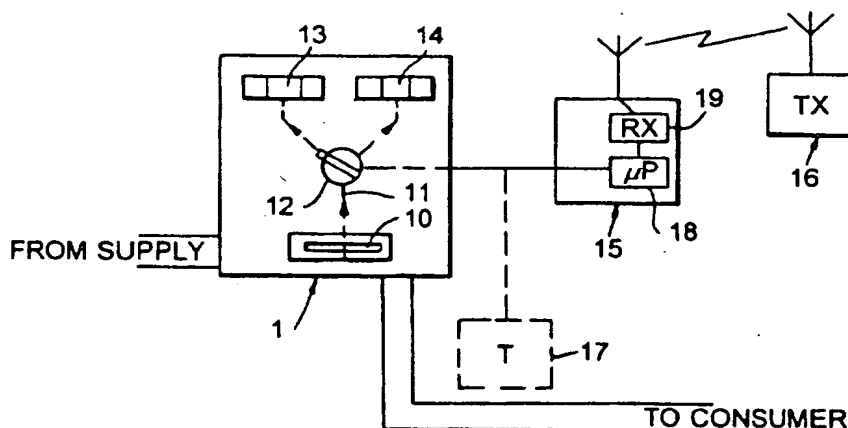


FIG. 2

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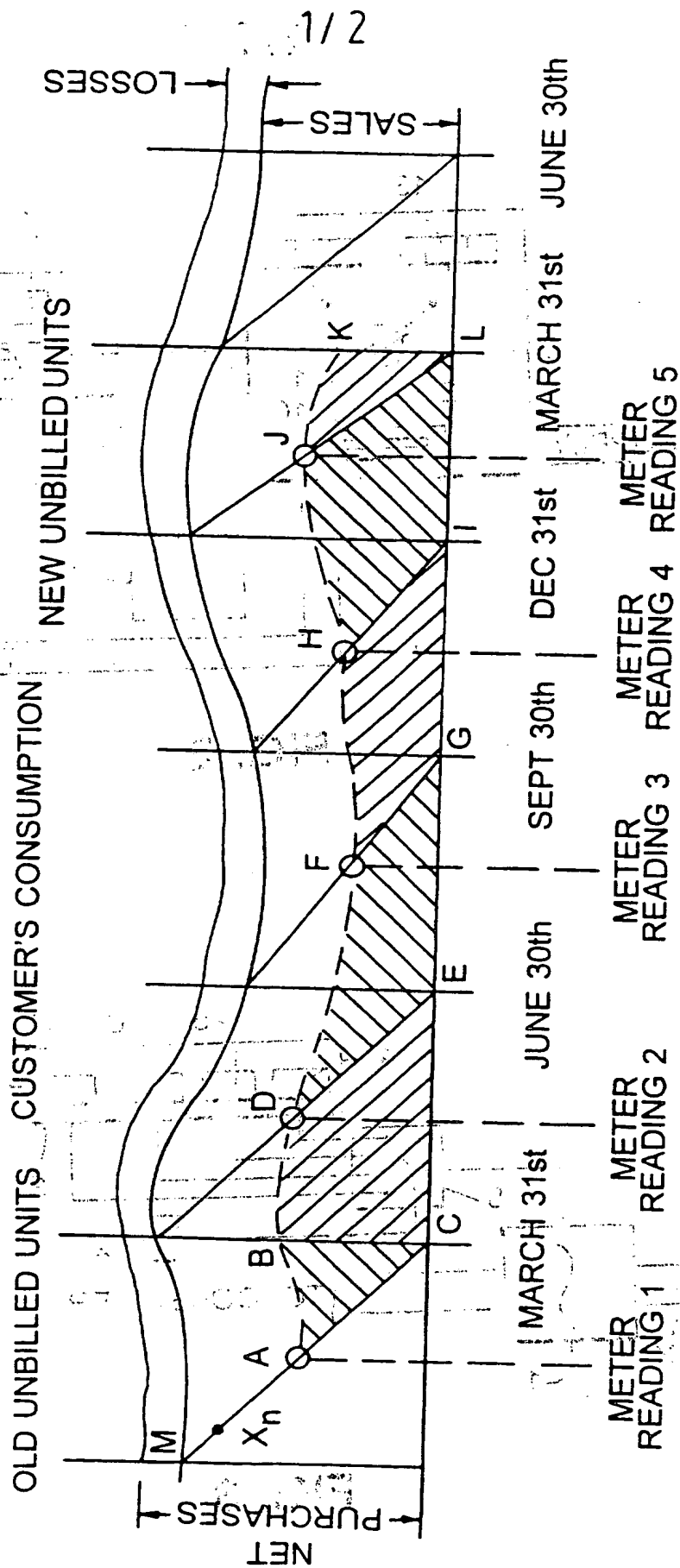


FIG. 1

SA 2/2

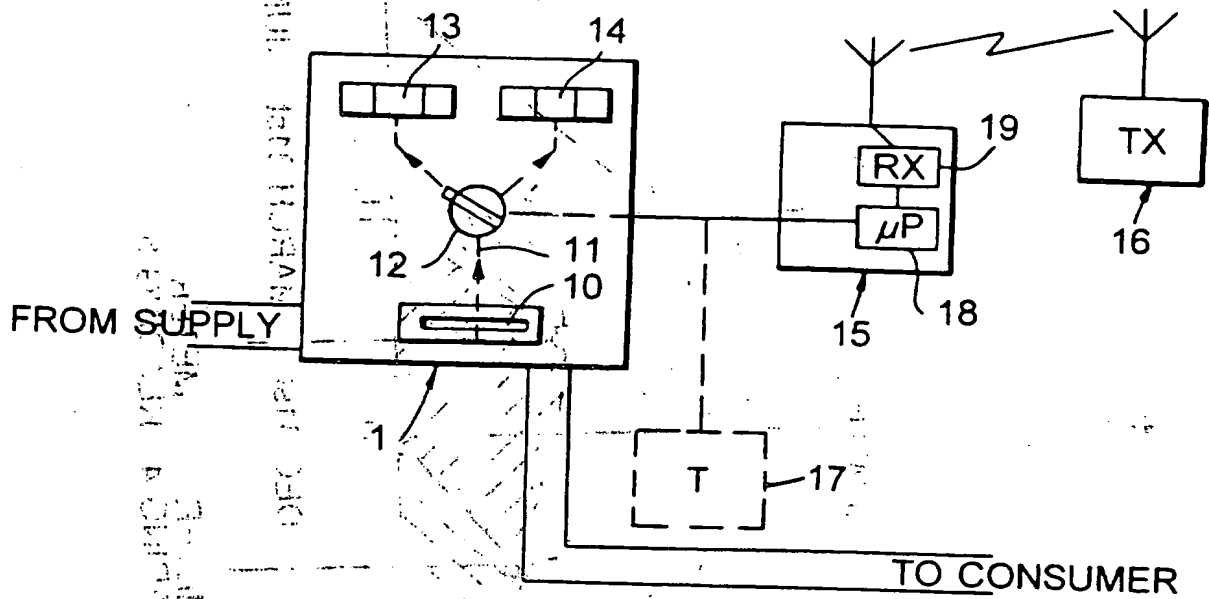


FIG. 2

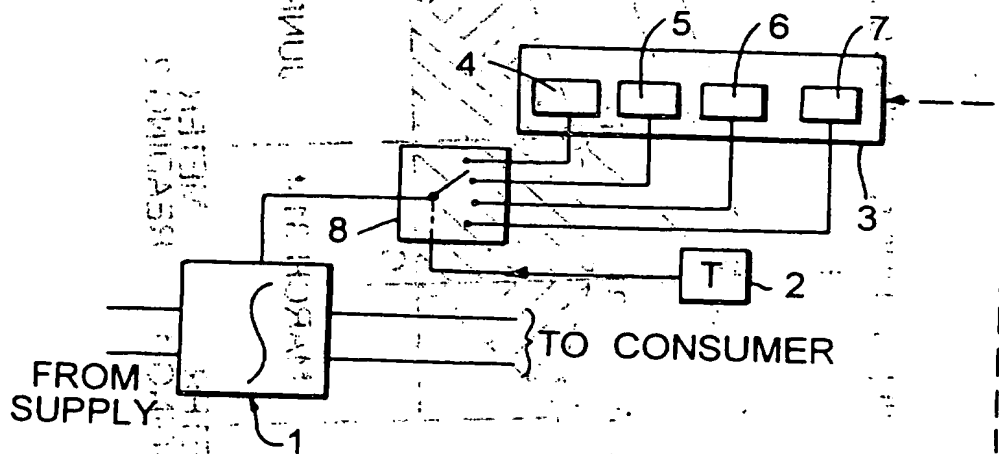


FIG. 3

UTILITY METERING ARRANGEMENT

The following invention relates to the metering of utilities and relates particularly, but not exclusively, to the metering of electricity consumption.

At present there are two types of electricity metering arrangements recognised by the Director General of Electricity Supply, namely:

- a) the domestic electricity meter in which the consumption of kWh is measured in "units" of electricity is electro-mechanically or electronically accumulated and displayed mechanically, the displayed being read periodically by a meter reader who visits the premises;
- b) industrial metering arrangements in which consumption is integrated during successive 30-minute periods and the number of units consumed in each period transmitted electronically to a remote computer for processing.

Although the above industrial metering arrangements b) above generate virtually instantaneous data they are expensive and are unsuitable for domestic installations, particularly bearing in mind that some 2½-million domestic consumers still do not have telephone lines.

The domestic electricity meters currently used are read normally on different dates by meter readers as they visit each house in turn, and hence there is never a "snapshot" picture of total electricity consumption at a specified date, e.g. at the end of an accounting period.

Similar problems exist with other utility meters e.g. gas and water meters.

Hence there is appreciable uncertainty in any profit figures generated by a utility company.

In particular the "accruals concept" set out in UK Statement of Standard Accounting Practice SSAP 2 paragraph 14(b), requires that revenue and costs are accrued (that is recognised, as they are earned or incurred, not as money is billed, received or paid), matched with one another so far as their relationship can be established or justifiably assumed, and dealt with in the profit and loss account of the period of which they relate. Revenue and profits dealt with in the profit and loss account are matched with associated costs and expenses by including in the same account the costs incurred in earning them (so far as these are material and identifiable).

Clearly the accounting needs implied by this concept cannot be met by the domestic utility meters currently available. Furthermore, losses occur in transmitting units of supply from the utility's source of bulk supply, to the consumer's meter, for example 100 units of water used by a domestic consumer

may require over 120 units to be produced from the reservoir due to losses due to leakages in the pipes, or 100 units of electricity used by a domestic consumer and may require over 110 units to be produced by a power station.

Any change in profitability due, e.g. to a change in leakage rate, cannot be directly measured by present arrangements.

An object of the present invention is to overcome or alleviate the above problems.

Accordingly, the invention provides a utility metering arrangement comprising

utility metering means arranged to meter accumulated consumption of the utility, register means arranged to register the current accumulated consumption of the utility, and switching means coupled between said metering means and register means, said register means having a plurality of registers, a first one of said registers being arranged to record the total consumption accumulated during a first accounting period and a second one of said registers being arranged to record the running total consumption being accumulated during a second accounting period immediately following said first accounting period, said switching means being arranged to switch said signal between said registers at the end of said first accounting period in response to a received date signal.

The date signal can indicate the date of the end of a quarterly accounting period for example, or the date of a change of supplier as envisaged by the "post 1998" Trading Arrangements for Domestic Electricity customers.

any other part of the system which may be used to generate said date signal.

Preferably the arrangement further comprises local timing means arranged to generate said date signal, the signal optionally indicating time in addition to the date. For example, the signal could be generated at midnight on 31st March and on the final date of each subsequent quarterly or annual accounting period, or at midnight on the date of change of supplier.

Alternatively, the arrangement could comprise remote signalling means arranged to transmit the date signal to said switching means at the end of an accounting period, the signal optionally indicating time in addition to the date.

Further preferred features are defined in the dependent claims.

Preferred embodiments of the invention are described below by way of example only with reference to the accompanying drawings, wherein:

Figure 1 is a diagram illustrating the uncertainty in domestic billing arrangements;

Figure 2 is a schematic block diagram showing an electro-mechanical electricity metering arrangement in accordance with the invention; and

Figure 3 is a schematic block diagram showing an electronic electricity metering arrangement in accordance with the invention.

Referring to Figure 1, a plot of electricity purchases by and electricity sales from an electricity supplier is shown for a period of five quarters. For the sake of simplicity it is assumed that the meter of the particular customer is read on (say) the 45th day of each quarter. This consumption is also plotted in Figure 1 (albeit to a different scale). Other customers' meters will be read on a different day (say n) of each quarter and this is illustrated by point X_n . Such a distribution is essential to ensure efficient employment of the company's meter readers.

The true annual consumption of the above customer is therefore proportional to the hatched area between BC and KL. However what is actually measured by the meter reader at each quarter is of course the consumption since the last quarter's reading (e.g. METER READING 1 - METER READING 2) and the best approximation to the corresponding financial quarter's consumption (in this case March 31st to June 30th) is represented by the area under curve ABD between diagonals AC and DE. This area includes old unbilled units represented by the area under curve AB between diagonal AC and vertical line BC. After meter reading 5 there will be new unbilled units represented by the area under curve CJK between diagonal JL and vertical line KL.

Hence the following relationship exists between net purchases, sales, losses, quarterly bills, old unbilled units and new unbilled units:

$$\text{NET PURCHASES} - \text{LOSSES} = \text{SALES} = \text{TOTAL (i.e. 4) QUARTERLY BILLS}$$

+ NEW UNBILLED UNITS - OLD UNBILLED UNITS.

The annual bill to any customer is only equivalent to that customer's annual consumption if $\text{NEW UNBILLED UNITS} = \text{OLD UNBILLED UNITS}$ and similarly the total of annual bills to the suppliers customers is only equivalent to the total sales of electricity if the total of unbilled units does not vary from year end to year end.

In general, neither of the above conditions will be met and there will consequently be accounting uncertainties. Similar problems will arise if a customer changes supplier.

An object of the present invention is to alleviate such problems.

Referring to Figure 2, the arrangement shown comprises an electromechanical "Economy 7" meter 1 of the type already in use in many domestic installations. It comprises a conventional Ferraris wheel 10 coupled to a mechanical drive train 11 which can be switched by a switch 12 between two mechanical registers 13 and 17. As shown, switch 12 is in a position in which the drive train 11 is switched to register 13, and therefore only increments this register as electricity is consumed by the consumer.

Switch 15 is controlled by a radio teleswitch receiver 15 module which incorporates a microprocessor arrangement 18 whose input is coupled to the output of a radio receiver 19. Module 15 includes a local clock (not shown).

A remote control unit comprising a radio transmitter 16 transmits 198kHz radio signals to all the company's receiver modules, the signals carrying group codes which are recognised by receivers 15 programmed with the appropriate group information and carrying portions of control data associated with the respective group codes for implementation by receivers 15 of the appropriate group. Such control data is used to control the operation of module 15 shown in Figure 2 so that switch 12 switches between register 13 and register 14 at midnight on the last day of each financial quarter, e.g. March 31st, June 30th, September 30th and December 31st. In order to assist the meter reader, register 13 can be labelled with its associated non-adjacent financial quarters (e.g. Q1 and Q3) and register 14 can be labelled with its associated (non-adjacent) financial quarters (e.g. Q2 and Q4). The registers 13 and 14 can be associated with the appropriate quarter in any other suitable manner - e.g. the currently non-incrementing register (which is to be read by the meter reader) could be indicated by a "READ" printer on switch 12.

Alternatively or additionally, the transmitted radio signals may be arranged to switch 12 between registers on a specified date when an electricity supplier changes.

As an alternative to module 15, a timer 17 generating date information may be arranged to generate the appropriate switching signals at appropriate dates.

Referring to Figure 3, the arrangement comprises an electricity meter 1 which integrates the power consumed by the consumer to generate an output signal indicating the running total of "units" (kWh) of electricity consumed by the consumer and supplied by the electricity company. For example, the meter 1 could comprise circuitry for multiplying the instantaneous current and voltage and integrating the product over time.

The output signal is fed via an electronic switching device 8 to a first register 4 of a register arrangement 3. A timing circuit 2 sends a first switching signal daily to switch 8 when the "off-peak" period begins, which causes the output of meter 1 to be recorded as a running total in a second register 5. When the "off-peak" period ends, timer 2 sends a second signal to switch 8 which returns the output signal of meter 1 to register 4, whose contents have in the meantime been retained by suitable memory circuitry (not shown). Thus register 4 accumulates a running total of "off-peak" electricity consumption and register 5 accumulates a running total of "off-peak" electricity consumption in kilowatt-hours.

At midnight, at the end of a quarterly accounting period, timer 2 sends a third signal to switch 8 which switches the output signal of meter 1 from "off-peak" register 5 to a further "off-peak" register 7. When that "off-peak" period ends, the timer 2 diverts the output of meter 1 to a further non-off peak register 6 and

"off-peak" and "peak" consumption is henceforth recorded in registers 7 and 6 respectively.

In the meantime, a meter reader visits the premises and reads the "non-off-peak" and "off-peak" consumption recorded in registers 4 and 5 respectively and the electricity supplier can then obtain the total consumption in the last completed accounting period of "off-peak" and "peak" electricity by adding the relevant figures read at different consumers' premises. Alternatively, in some cases this data could be obtained by means of a remotely-generated interrogation signal S which could be transmitted e.g. over a telephone line and cause the data to be transmitted back via the telephone line.

When the next accounting period ends the timer 2 sends a further signal to switch 8 which freezes registers 6 and 7, clears registers 4 and 5 and causes "peak" electricity consumption to be recorded once again in register 4 and "off-peak" consumption to be recorded once again in register 5, as initially described.

The above cycle is then repeated.

Thus it will be apparent that the register arrangement 3 always records

- a) the total "peak" and "off-peak" consumption in the previous accounting period

b) the running total "peak" and "off-peak" consumption in the current accounting period.

The above information is preferably displayed on a visual display, but may, additionally or alternatively, be stored purely electronically for downloading via a suitable connection to an electronic reader carried by the meter reader who visits the premises.

It will be apparent that the above apparatus can be easily modified to record the consumption of other utilities such as water and gas.

Furthermore it may be feasible to switch between registers only at the end of each financial year rather than at the end of each quarter if this produces sufficient information for the financial report of the utility concerned.

CLAIMS

1. A utility metering arrangement comprising utility metering means arranged to meter accumulated consumption of the utility, register means arranged to register the current accumulated consumption of the utility, and switching means coupled between said metering means and register means, said register means having a plurality of registers, a first one of said registers being arranged to record the total consumption accumulated during a first accounting period and a second one of said registers being arranged to record the running total consumption being accumulated during a second accounting period immediately following said first accounting period, said switching means being arranged to switch said signal between said registers at the end of said first accounting period in response to a received date signal.

2. A utility metering arrangement according to Claim 1, further comprising local timing means arranged to generate said date signal, the signal optionally indicating time in addition to the date.

3. A utility metering arrangement according to Claim 1, further comprising remote signalling means arranged to transmit the date signal to said switching means, the signal optionally indicating time in addition to the date.

4. A utility metering arrangement according to any preceding claim wherein said register means is arranged to display simultaneously the accumulated

consumption recorded by said first and second registers.

5. A utility metering arrangement according to any preceding claim wherein

said register means further comprises means additional registers arranged to record accumulated off-peak consumption during said first and second accounting periods respectively.

6. A utility metering arrangement according to any preceding claim wherein

said register means is responsive to an interrogation signal to download the contents of at least one register.

7. A utility metering arrangement according to Claim 6, further comprising

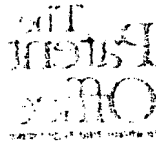
remote signalling means arranged to generate said interrogation signal and means for transmitting said register contents to a remote location.

8. A utility metering arrangement according to any preceding claim wherein

said utility metering means is arranged to measure accumulated consumption of electricity, gas or water.

9. A utility metering arrangement according to any preceding claim which is

associated with an installation having a capacity of supply of 100A or less.



10. A utility metering arrangement substantially as described hereinabove with reference to Figure 1 or Figure 2 of the accompanying drawings.

TABLE 1	
ITEM NO.	DESCRIPTION
1	UTILITY METERING ARRANGEMENT
2	UTILITY METERING ARRANGEMENT
3	UTILITY METERING ARRANGEMENT
4	UTILITY METERING ARRANGEMENT
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9	UTILITY METERING ARRANGEMENT
10	UTILITY METERING ARRANGEMENT



The
Patent
Office

Application No: GB 9626873.5
Claims searched: 1 - 10

Examiner: John Watt
Date of search: 3 March 1997

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): G1U (UR1116, UR1156, UR1157, UR1158, UR21133)

Int CI (Ed.6): G01R 11/16, 11/56, 11/57, 11/58, 21/133

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	GB 2290623 A (LANDIS & GYR) see figure 2 page 1, lines 7 - 10 and page 2, lines 1 - 10	1 - 3 and 5 - 9
Y	GB 0481873 A (SANGMO) see figures 1 - 3 and page 1, lines 75 - 97	1 - 3 and 5 - 9
Y	EP 0295864 A2 (BODRUG ET AL) see figures 1 - 12 and column 4, lines 21 - 37	1 - 3 and 5 - 9
Y	US 4218737 (US ARMY) see figures 1 & 2 and column 2, lines 49 - 55	1 - 3 and 5 - 9

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.

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